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BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	
1998 Biennial Regulatory Review —	)	
Amendment of Parts 2, 25 and 68 of the	)	
Commission's Rules to Further Streamline the	)	
Equipment Authorization Process for Radio	)	GEN Docket No. 98-68
Frequency Equipment, Modify the Equipment	)	
Authorization Process for Telephone Terminal	)	
Equipment, Implement Mutual Recognition	)	
Agreements and Begin Implementation of the	)	
Global Mobile Personal Communications by	)	
Satellite (GMPCS) Arrangements	)	

To: The Commission

COMMENTS

The U.S. GPS Industry Council ("the Council"), by counsel and pursuant to Sections 1.415 and 1.419 of the Commission's rules, hereby comments on the Commission's proposals in the above-referenced docket to adopt interim procedures for the certification of ground segment equipment for use in the provision of Global Mobile Personal Communications Services by Satellite ("GMPCS").[1/] In particular, the Council is concerned that the Commission's desire to "allow for the expedient certification of GMPCS equipment as soon as possible" could have an unacceptable adverse impact on the operations of radionavigation satellite service ("RNSS") systems, including the United States Global Positioning Systems ("GPS").

The Council emphasizes that it is committed to joining with GMPCS service providers to develop expeditiously a timely and appropriate test program leading to workable standards that will permit safe operation of GMPCS equipment in conjunction with existing GPS

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1/ *See Notice of Proposed Rule Making*, FCC 98-92, slip op. at 18 (¶45) (released May 18, 1998) ("NPRM").

devices in a manner that benefits their mutual customers. These studies must be completed, and their results taken into account, before GMPCS providers are permitted to operate equipment in bands adjacent to those used for provision of GPS for radionavigation and safety-of-life services.

Commercial applications of GPS do not compete with GMPCS. If anything, the two services are complementary, and in many applications, co-dependent. The Council and its individual members look forward to working with GMPCS operators to maximize their synergies and to develop and bring advanced information and communications products to the marketplace. GPS and GMPCS are natural allies. These comments are intended to open a constructive dialogue among the parties, not to create barriers to the early introduction of GMPCS. The Council invites the GMPCS community to participate in an open, transparent and a jointly conducted test program to develop potential interference data and to address and find mutually agreeable means of solving potential interference problems.

I. INTRODUCTION AND STATEMENT OF INTEREST

The U.S. GPS Industry Council is a non-profit 501(c)(6) industry trade association whose mission is to be an information resource to the Government, the media, and the public on GPS. The Council's purpose is to promote sound policies for the development of commercial markets in civilian application, while preserving the military advantages of GPS. Current membership includes the principal U.S. manufacturers of GPS equipment — e.g., Boeing, Honeywell, Magellan/Ashtech, Rockwell International, and Trimble Navigation.

The Council represents a significant sampling of the hundreds of manufacturers of GPS equipment and the millions of users of GPS signals. On behalf of its numerous members,

many of whom are engaged in activities with safety-of-life implications, the Council is concerned that operation of GMPCS equipment under certain conditions could cause loss of GPS signal reception or errors in position or time accuracy. Either of these consequences is intolerable for a safety-of-life service.

Many GPS users now have extensive operational reliance on GPS based on their confidence in the predictability, stability, and integrity of the RNSS frequency band for safety-of-life services. The most sensitive GPS receivers now in operation use the band 1565.19-1585.65 MHz. The introduction of a noise presence in the band used by GPS at the levels of the interim out-of-band emissions ("OOBE") proposed in the NPRM may have a significant negative impact on operational users of GPS and safety-of-life applications. The determination of the exact magnitude of the effect of the interference and the implications for GPS users requires rigorous review and testing before any additional mobile Earth terminals ("METs") are authorized.

The Council understands that all publicly available analyses leading to the current proposed OOBE limits for the GPS band, which are cited in the NPRM,[2/] have been theoretically based. The proposed interim OOBE limit of –70 dBW/MHz that would apply to GMPCS Earth terminals has been based exclusively on an analysis of GPS aviation receivers in a narrowly circumscribed aircraft landing scenario. The -70 dBW/MHz value was not derived with the broad current usage of GPS in mind or the possibility of jamming without the presence of an aircraft fuselage to serve as an anti-jamming shield.

Through these comments, the Council seeks to make the Commission aware of the need to consider in discussions of the protection to be accorded to GPS operations the heretofore unaddressed concerns of the larger GPS land, marine, and general aviation user base — *where the*

2/ NPRM, FCC 98-92, slip op. at 17-18 (¶44-45).

interference concerns are both more varied and in many ways more immediate than they are in the specific aviation scenario previously considered. These concerns clearly indicate that it is timely and prudent for the GPS industry, GPS users, and the mobile-satellite service ("MSS") industry to work constructively together to prevent unintended adverse consequences. Such a joint effort is critical, given the convergence occurring already in the marketplace among navigation, positioning, timing, and communications, including mobile-satellite services. Consequently, the Council is highly motivated by self-interest and the interests of GPS users worldwide to fully support a successful launch of MSS services under the procedures ultimately adopted for certification of GMPCS equipment.

II. DISCUSSION

A. The Millions Of GPS Receivers In Civilian Use Today, As Well As Those To Be Placed Into Service In The Coming Seven Years, Will Require Protection From Out-Of-Band Emissions In The Band 1565.19-1585.65 MHz.

There are between three million and five million GPS receivers in use around the world today in the RNSS band at 1559-1610 MHz. GPS receivers are used in an ever increasing number of applications, a very large percentage of which involve safety-of-life applications. For example, in aviation, GPS receivers are used for transoceanic and en route navigation, and for wind shear detection. In maritime environments, GPS receivers are used, for instance, for navigation on the high seas, search and rescue, positioning of buoys and marine navigation aids, docking of high-speed ferries, and precision coastal and harbor approach operations. GPS is also vital to the differential beacon augmentation systems for increased accuracy in the coastal confluence zones of many nations around the world. In surface transportation, GPS receivers are used in such critical applications as monitoring of bridge status and train control and collision

avoidance. GPS is an enabling technology for the nation's emerging Intelligent Transportation Systems ("ITS") infrastructure. Municipalities are increasingly relying on GPS for use in ambulance, police and fire department dispatch, and to locate disabled or distressed vehicles. Emergency medical response units (paramedic ambulances and helicopters) increasingly rely on GPS-based operations, as do providers of disaster relief for hurricanes, floods, earthquakes, and fires. Myriad other applications in such fields as telecommunications (for network synchronization and satellite tracking), construction, surveying, weather forecasting/monitoring, earthquake monitoring, passenger and cargo transportation, environmental protection, natural resource management, law enforcement, agriculture, oil and gas exploration, rig positioning and movement, supertanker tracking and docking, and mining are already established and in use. Dozens of new and enhanced applications are coming on line every year.

RNSS systems require passive, receive-only devices. They cannot avoid interference from adjacent-band communications systems to GPS receivers that occurs at levels above which positive link margins can be maintained. The constraint is imposed by the GPS system design, not by the design of the user equipment.[3/] Interference from MET OOB emissions will manifest itself in either of two ways. First, the GPS receiver may not receive enough signals to develop a navigation solution (i.e., service will be interrupted). Because GPS receivers are increasingly being integrated into complex systems, the operator of the system may never know that it is not receiving sufficient GPS information as a result of interference from OOB emissions. Second, the interference, short of totally blocking reception of the GPS signal, may cause erroneous information to be received. The operational consequences of the non-receipt of expected messages and of the receipt of inaccurate positioning or timing information are both

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[3/] The GPS system specification has been in the public domain since at least 1984.

obvious and potentially dire. In either case, public safety could be compromised. Given the increasing reliance of city, county, and state governments on GPS, establishment of any standard for OOBE interference to GPS, whether interim or final, that does not ensure adequate protection would not appear to be consistent with the public interest, convenience, and necessity.

B. The Interim OOBE Standard Derived From The Still Pending NTIA Petition For Rule Making May Not Adequately Protect GPS.

In the NPRM, the Commission proposes to condition interim approval for GMPCS terminal equipment on "the ability of the applicant to meet the strictest out-of-band emission limit proposed at this time," *i.e.*, the values put forth in the petition for rule making of the National Telecommunications and Information Administration ("NTIA"), which was filed with the Commission in September 1997.[4/] The power levels and regulatory mechanisms proposed by NTIA — while ostensibly designed to facilitate the ability of 1.6 GHz MSS systems to operate in a band proximate to the Russian RNSS system known as GLONASS [5/] — may not necessarily ensure that GPS receivers operating up to 1585.65 MHz are adequately protected from out-of-band emissions from those same METs.

The NTIA Petition contains the following proposal with respect to GPS protection:

4/ *See* Letter from Richard D. Parlow, Associate Administrator, Spectrum Management, NTIA, to Regina Keeney, Chief, International Bureau, FCC, dated September 18, 1997, RM-9165 ("NTIA Petition"). NTIA's petition was placed on public notice in 1997, and comments and reply comments were filed at that time, but the Commission has not proposed new rules that reflect either NTIA's proposal or any of the views expressed in responsive comments.

5/ The Russian GLONASS system has identified the upper portion of the 1559-1610 MHz band for its operations, and is expected to require protection from MET out-of-band emissions only below 1605 MHz once GLONASS achieves its final configuration.

GPS Protection

1) METs operating in the band 1610-1660.5 MHz shall conform to OOB limits of -70 dBW/MHz for wide band signals in the band 1559-1580.42 MHz, and to -80 dBW/700 Hz for narrow band signals in the band 1559-1585.42 MHz for the protection of GPS receivers.

NTIA Petition at 2. NTIA, however, does not explain why GPS should be protected from narrowband signals up to 1585.42 MHz, while its protection from wideband signals should stop at 1580.42 MHz. Nor does NTIA explain why even its protection range with respect to narrowband signals does not extend to the full band (i.e., to 1585.65 MHz) that is used by many of today's GPS receivers.

The Commission now proposes to adopt NTIA's foregoing suggested OOBE limits as an interim standard for evaluating GMPCS MET applications.[6/] The Council's concern that the proposed OOBE limit may not adequately protect many GPS applications is not based on generalized observations. Preliminary analysis of the potential interference into GPS receivers from GMPCS terminals operating at the power levels proposed in the NPRM (see attached Declaration of Stanford University Professor Per Enge) shows that GPS receivers could be subject to unacceptable levels of interference from GMPCS terminals. Empirical analyses of these preliminary conclusions have begun, and early results, based on white noise experiments, have validated the existence of a potential problem with the OOBE limits proposed in the NPRM.

6/ The Council intends to participate in any separate rulemaking proceeding prompted by NTIA's petition. *See* NPRM, FCC 98-92, slip op. at 17 (¶44) ("The Commission will initiate a separate rule making to consider the NTIA proposal.").

Given the number of GPS receivers in actual use in the terrestrial, maritime and general avation environments, many in safety-of-life applications, Dr. Enge's conclusions give rise to serious concerns that the Commission's proposed interim OOBE limits may provide inadequate protection from interference to the millions of GPS receivers already in use in terrestrial, maritime, and general aviation safety-of-life applications.

The Council is cognizant of ITU's Radio Regulation S4.10 which requires special measures to protect safety-of-life radiocommunications services. The Commission's own rules reflect this requirement.[7/] Regardless of the interference-mitigating OOBE limits set out in this NPRM — on an interim basis or otherwise — S4.10 controls. This is even more reason for GMPCS operators to join now in a joint study program to address the concerns of the GPS community.

As the sole operator of the GPS system, the U.S. Government is mandated by the U.S. Congress to ensure efficient management of, and to protect from disruption and interference, the electromagnetic spectrum used by the GPS. *See* Section 1074(a)(5)(c) of the 1998 Defense Authorization Act. Consequently, at this point, it is vital for the U.S. Government to avoid presumptive judgments that could affect the continuity of such critical services in the absence of credible evidence that harmful interference will not result. These factors must be accommodated and appropriate evidence must be obtained before interim Certification standards are adopted and applied and applications are granted.[8/]

7/ *See* 47 C.F.R. § 2.1(c)(1997) ("harmful interference," which is pervasively prohibited under the Commission's rules, is defined, in part, as "interference which endangers the functioning of a radionavigation service or of other safety services...").

8/ It is possible that sufficient protection may be afforded, on an interim basis, through a requirement that MSS handsets and other Earth terminals be outfitted with appropriate

(continued...)

The Council emphasizes that it has no quarrel with the GMPCS/MSS community's desire to establish practicable out-of-band emission values at the 1605 MHz band break. It is the impact of MET out-of-band emissions in portions of the RNSS band below 1605 MHz, and the disruption such emissions would cause both to the current installed base of GPS terminals and to future GPS operations, that are of concern. The Council is reliant, for continued safe operation of GPS applications which they develop and employ, on the stability, consistency, and freedom from interference of the GPS signals provided by the U.S. Government. Indeed, since the first GPS receiver was developed in 1984, the continuous, market-driven evolution of passive receiver technology is premised upon the predictable integrity of the RNSS spectrum. The U.S. Government has committed, in its biennial Federal Radionavigation Plan and, more significantly, in several statements by the President, the Vice President, and the Congress, that the GPS would provide reliable service in support of safety of life for all modes of transportation.[9/] Such statements and commitments would appear to require that strenuous measures be taken, including on-the-air testing of operational equipment, to ensure these services are in no way disrupted by the

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[8/] (...continued)
filters. The Council looks forward to an opportunity to constructively and cooperatively address this issue, and encourages an expedited exchange of test data on the interference impact of out-of-band emissions on GPS receivers.

[9/] *See, e.g.,* 1996 Federal Radionavigation Plan ("FRP"), Section 1; *id.* at Section 1.11 (covering 1980-1996 FRPs). *See also* Letter dated March 16, 1995, from President Clinton to the International Civil Aviation Organization; Public Law 105-85, National Defense Authorization Act for Fiscal Year 1998, Section 1074(a)(5)(c) (Sustainment and Operation of the Global Positioning System); The White House, Office of Science and Technology Policy, National Security Council, Fact Sheet: U.S. Global Positioning System Policy, March 29, 1996, Pages 1-3 (Reference: Presidential Decision Directive NSTC-6); The White House, Office of the Vice President, Vice President Gore Announces Enhancements to the Global Positioning System that will Benefit Civilian Users Worldwide (March 30, 1998).

introduction of new signals and services in adjacent bands before those new services are, in fact, approved for introduction.

III. CONCLUSION

For the foregoing reasons, the Council urges the Commission to defer proceeding with the adoption of an interim GMPCS equipment certification standard until it has had an opportunity to consider the issues raised in these comments. The Council is cognizant of the desires of operators of 1.6 GHz band GMPCS to clear the remaining regulatory hurdles and proceed to the service initiation phase. It is only with the greatest reluctance, and out of the need to preserve the integrity of the GPS system on which over three million to five million users directly rely and many times that number rely indirectly, that it requests here that the Commission undertake a more thorough investigation before establishing standards for certification of MSS METs operating above 1610 MHz.

Respectfully submitted,

U.S. GPS INDUSTRY COUNCIL

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July 27, 1998

Its Attorneys

DECLARATION

I, Per Enge, hereby declare, under penalty of perjury, that:

1. I am a Professor (Research) in the Department of Aeronautics and Astronautics, College of Engineering, Stanford University. I hold a Ph.D. in Electrical Engineering. My research has focused on system design in the field of global positioning by satellites. I am widely published in the field and hold several related patents.

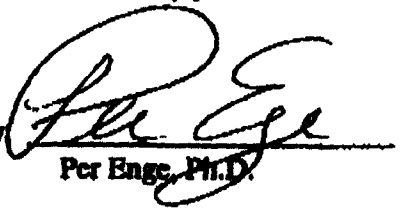
2. I have been retained by the U.S. GPS Industry Council to analyze the potential interference that Global Positioning System (GPS) receivers would receive from mobile Earth terminals (METs) operating in the 1610-1626.5 MHz band with the out-of-band emission levels that the Federal Communications Commission (FCC) has proposed in GEN Docket No. 98-68 for interim application to satellite Global Mobile Personal Communications Systems in this band.

3. Based on my theoretical evaluation of the interference situation, the FCC's proposal to permit mobile Earth terminals to produce emissions in the GPS operating band at levels of -70 dBW/MHz, even on an interim basis, could subject certain GPS receivers to significant levels of interference. In particular, a MET that produces out-of-band emissions at this level in the GPS operating band in proximity of certain GPS receivers currently in use in terrestrial and marine applications could cause harmful interference to these GPS receivers.

4. The primary effect of the interference will be to raise the noise floor of the GPS receiver. At low interference levels, the GPS receiver will suffer a loss of accuracy; as the level of interference increases, the GPS receiver will lose track on the satellites with the weakest signals, and eventually, enough satellites will be lost that navigation and/or timing service will be disrupted. Where out-of-band emissions from METs fall on this continuum is still under study.

5. Preliminary results of experiments I have conducted on white noise have corroborated my theoretical evaluations of the problem.

6. I am developing a study program to establish the scope of the interference problem posed by MET out-of-band emissions in the GPS band, and to identify potential solutions.

By: 

Per Enge, Ph.D.

Dated: July 27, 1998